(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 November 2005 (24.11.2005)

PCT

(10) International Publication Number
WO 2005/111281 A1

(51) International Patent Classification[7]: D01D 5/42, D01F 8/06, E01C 13/08

(21) International Application Number: PCT/NL2005/000275

(22) International Filing Date: 11 April 2005 (11.04.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1026239 19 May 2004 (19.05.2004) NL

(71) Applicant *(for all designated States except US)*: **TEN CATE THIOLON B.V.** [NL/NL]; G.Van der Muelenweg 2, NL-7443 RE Nijverdal (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **VAN DER GAAG, Frederik, Jan** [NL/NL]; Valeriaan 21, NL-7443 KC Nijverdal (NL). **OLDE WEGHUIS, Marinus, Hendrikus** [NL/NL]; Enschedesestraat 119, NL-7574 AB Oldenzaal (NL). **SLOOTWEG, Geurt, Bastiaan** [NL/NL]; Helioslaan 26, NL-7534 HW Enschede (NL).

(74) Agents: **VALKONET, Rutger** et al.; Algemeen Octrooi-en Merkenbureau, P.O. Box 645, NL-5600 AP Eindhoven (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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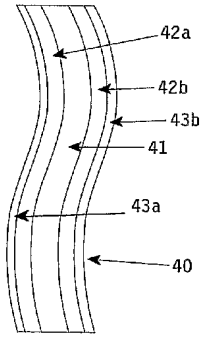
(54) Title: METHOD FOR PRODUCING A SYNTHETIC FIBRE FOR USE IN AN ARTIFICIAL GRASS SPORTS FIELD AND SUCH A SYNTHETIC FIBRE



(57) Abstract: The invention relates to a method for producing a synthetic fibre for use in an artificial grass sports field, comprising the steps of: i) supplying a layer of synthetic material; and ii) obtaining the synthetic fibre from the layer of synthetic material.The invention also relates to such a synthetic fibre and to an artificial lawn suitable for sports fields, consisting of a substrate to which synthetic fibres according to the invention have been attached. The object of the invention is therefore to provide a more universal fibre, which on the one hand can be produced for a specific use and on the other hand saves on production and material costs. According to the invention, the layer of synthetic material is composed of at least two layers of different synthetic materials, using a co-extrusion process. The co-extrusion step provides a separation of the different properties of the synthetic materials that are used.

WO 2005/111281 A1

Published:
— *with international search report*

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Method for producing a synthetic fibre for use in an artificial grass sports field and such a synthetic fibre.

DESCRIPTION

The invention relates to a method for producing a synthetic fibre for use in an artificial grass sports field, comprising the steps of:

i) supplying a layer of synthetic material; and

ii) obtaining the synthetic fibre from the layer of synthetic material.

The invention also relates to such a synthetic fibre and to an artificial lawn suitable for sports field, consisting of a substrate to which synthetic fibres according to the invention are attached.

Currently, synthetic materials are being used for various purposes. Especially the use of various sorts of synthetic materials in artificial lawns for sports fields has markedly increased in recent years.

Research in this regard has in particular been concentrated on the development of synthetic fibres for use in artificial lawns for sports fields, in which fibres of a particular length are attached to a substrate, for example by tufting. The development of artificial grass fibres and artificial grass sports fields derived therefrom has progressed so far that it is now possible to construct artificial grass sports fields which are very difficult to distinguish from natural grass sports fields, not only as regards the way they look but also, and in particular, as regards the way they function during play.

Unlike natural grass sports fields, artificial grass sports fields can be played on longer and more intensively, irrespective of the weather conditions. Currently, the development of new artificial grass fibres is particularly focussed on obtaining a fibre which will further reduce the incidence of injuries such as grazes and burns caused by

sliding or twisted joints.

Existing fibres specifically developed for artificial grass sports field are obtained from a layer of synthetic material, for example by means of a cutting operation. The layer of synthetic material may consist of a mixture of different synthetic materials, for example, with one synthetic material serving to give the fibre a certain strength (against breaking or splitting), whilst another synthetic material in the mixture provides the fibre with a certain elasticity or flexibility or better sliding properties.

A drawback of such existing synthetic fibres is the fact that, due to the homogeneous structure all (sub)properties of the fibre are homogeneously incorporated in the fibre. As a result, certain properties of the fibre may be less prominently present than is desirable, whilst other properties predominate more than is desirable. Therefore, the composition of the current fibres is usually standardized and often their production and material costs are unnecessarily high.

The object of the invention is therefore to provide a more universal fibre, which on the one hand can be produced for a specific use and which on the other hand saves production and material costs. According to the invention, the layer of synthetic material is composed of at least two layers of different synthetic materials, using a co-extrusion process.

The co-extrusion step accomplishes a separation of the various properties of the synthetic materials that are used. By providing the synthetic fibre with a layered structure, it becomes possible to provide each layer with a function-specific property, which property does not need to be present elsewhere in the fibre, or needs to be present only to a markedly reduced degree. This makes it possible to select the formulation for the fibre specifically for a certain use, which, in addition to a more efficient material consumption, also results in a synthetic fibre with markedly improved playing and fibre properties than

in the homogeneously composed known fibres.

According to the invention, the playing properties of the synthetic fibre can be significantly improved by stretching the fibre after the co-extrusion process. Apart from an increase in length, according to the invention it is precisely the selection of materials after the stretching process that provides a fibre with such strength properties in a transverse direction that it will split less easily, for example. When used in an artificial grass sports field, such a fibre, and consequently the artificial lawn, will have a much longer life, and the artificial lawn will require much less maintenance, thus remaining playable longer. Furthermore, the risk of injury of the players is considerably reduced.

According to the invention, the fibre may consist of at least one or of several twined monofilaments. The fibre may be formed as a band, and more in particular the band fibre may be formed as a fibrillated band fibre.

In a first functional embodiment of the process according to the invention, the layer of synthetic material is composed of a core layer of a first synthetic material, which core layer is surrounded on both sides by one or several outer layers, each consisting of a different synthetic material.

Thus a functional separation of the different properties of the different synthetic materials can be achieved, in which each layer of synthetic material has a function-specific property, which is not necessary or not functional elsewhere in the fibre.

The layers may have different thicknesses, depending on the desired function-specific properties of the synthetic fibre to be obtained.

In a first embodiment, the first synthetic material consists of a mixture of a polymer and a plastomer, in which in particular the ratio of the plastomer in the core layer is 30-80 wt.% and

more in particular the ratio of the plastomer in the core layer is 30-50 wt.%. This results in a fibre having a core layer which, from a function-specific viewpoint, exhibits a very favourable non-splitting behaviour.

In another embodiment, at least one of the other synthetic materials may comprise a hydrophilic additive. The artificial grass fibre thus obtained has this function-specific characteristic that it can absorb moisture (water). This will keep the artificial grass sports field moist longer, which has a positive effect on playing behaviour (slides etc.). When the field is played on, the absorbed moisture is released, the same as with natural grass.

An example of a hydrophilic additive that can be used as the top layer or outer layer of the co-extrusion fibre is ethylene vinyl alcohol copolymer. Depending on the quantity of vinyl alcohol in the copolymer, this polymer is capable of absorbing much water.

Another embodiment of a hydrophilic additive is the use of polyhydroxyethyl methylacrylate.

In yet another embodiment, at least one of the other synthetic materials may comprise an antistatic additive. As a result, any static electricity generated when the field is played on can discharge. Usually, the strewing material between the fibres, which is used in many artificial grass sports fields, is statically charged during play and as a result migrates upwards in the field. Thus, the granular strewing material can be spread through the air, which is less pleasant during play.

The antistatic additive furthermore ensures that no static discharges will take place via the players.

More specifically, the antistatic additive may be a polymer, especially a permanent antistatic, such as a polyamide or a polyether block amide. In another embodiment, the additive is a polyester block copolymer.

The invention will now be explained in more detail with

reference to a drawing, in which:

Figs. 1A-1D show different embodiments of a synthetic fibre according to the invention;

Figs. 2A and 2B schematically show a few embodiments of an artificial grass sports field provided with a synthetic fibre obtained by using the method according to the invention.

The fibres (10, 20, 30, 40) have been obtained from a foil of a synthetic material, which foil, obtained by co-extrusion, is composed of at least two layers of different synthetic materials (11, 12) as shown in Fig. 1A. Contrary to the currently known synthetic fibres, which are composed of a homogeneous mixture of synthetic materials, the layered structure of the synthetic fibre (10, 20, 30, 40) according to the invention makes it possible to provide each layer (sub-layers 11 and 12 in this embodiment) with a function-specific property. As a result, the use of a synthetic material having a specific property in a particular part of the synthetic fibre obviates or strongly reduces the need for the presence of this synthetic material and the related function-specific property elsewhere in the fibre.

For example, it is possible to use a synthetic material for the sub-layer 11 which in principle provides the synthetic fibre with the required mechanical strength (and rigidity) and which in particular non-splitting properties such that the synthetic fibre used for the artificial grass sports field will not split as a result of being played on.

In another embodiment as shown in Fig. 1B, the synthetic fibre 20 is built up of three layers of three different synthetic materials indicated by reference numerals 21, 22, 23. The middle layer 21 is made of an inexpensive synthetic material that is to give the fibre 20 its mechanical strength, whilst the outer layers 22 and 23 may be made of different synthetic materials, each of which may exhibit a different function-specific property, which property comes out best on the outer

side of the synthetic fibre rather than in the centre.

Thus, the outer layers 21 and 22 may have an elastic property, for example, contrary to the inner layer 21, which provides the fibre with a certain rigidity (against breaking or splitting), which elastic property of the outer layer 21 or 22 has a positive effect on the playing properties of the artificial grass sports field.

Whereas in the embodiment in Fig. 1B the outer layers 22 and 23 may be made of different synthetic materials, Fig. 1C shows an embodiment in which the outer layers 32A and 32B are made of the same synthetic material.

Fig. 1D shows a further, more complex layered structure of a synthetic fibre according to the invention. By means of co-extrusion of different synthetic materials, a layered synthetic fibre made up of a central core 41 and surrounded by different types of outer layers 42A-42B or 43A-43B, respectively, is obtained.

The essence of the method according to the invention and the synthetic fibres according to the invention obtained thereby lie in the fact that the synthetic fibre, contrary to the known synthetic fibres, does not have a homogeneous structure in which all different synthetic materials and the related properties are homogeneously incorporated in the fibre. As a result of the homogeneous structure or composition of the existing artificial grass sports fields, certain properties of the fibre may be present less prominently than is desirable, whereas other properties are now predominantly present than desired.

Using the method according to the invention, it is possible to obtain synthetic fibres according to a specific formulation that, contrary to the standardized fibres, exhibit a function-specific property in certain parts of the fibre that is not considered necessary or desirable elsewhere in the fibre.

This enables a more efficient use of the various

(synthetic) materials, which not only serves to reduce costs but also provides a more universal synthetic fibre according to the invention having markedly improved playing and fibre properties than in the homogeneously constructed known fibres. In this specific embodiment, the inner layers 11, 21, 31 and 41 may be made of a more inexpensive synthetic material that in principle provides the fibre with a certain strength against breaking or splitting. The outer layers 12, 22, 32, 32A-32B, 42A-42B and 43A-43B may be made of a synthetic material that does not necessarily need to be present in the fibre core.

In this context, a specific embodiment may be made up of an outer layer built up of an antistatic additive. The antistatic additive prevents the fibre from being charged by means of static electricity generated as a result of the artificial grass sports field being played on. Contrarily, the antistatic additive precisely ensures that the generated static electricity can discharge from the artificial grass sports field and, for example, will not discharge via the players, which can lead to unpleasant experiences.

In addition, in most artificial grass sports fields a granular strewing material (usually made of a rubber-like material) is used, which, due to the static electricity that is generated, migrates upward in the artificial grass sports field and which is spread through the air as a result of the field being played on. The airborne granular strewing material has a disturbing effect on the players.

The antistatic additive in particular is a permanent antistatic, possibly a polymer, such as a polyamide or polyether block amide. In another embodiment, the additive is a polyester block copolymer.

In another embodiment, one of the outer layers (or both outer layers) (12, 22-23, 32a-32b, 43a-43b) may comprise a hydrophilic additive. The artificial grass fibre thus obtained has the function-specific characteristic that it can absorb moisture (water) from the

atmosphere, such as rain. This makes the artificial grass sports field remain moist longer, just like a natural-lawn sports field, which has a positive effect on the playing behaviour in particular when sliding etc. While the field is being played on, the absorbed moisture is released, the same as with natural grass.

An example of a hydrophilic additive that can be used as the top layer or outer layer (12, 22-23, 32a-32b, 43a-43b) of the co-extrusion fibre is ethylene vinyl alcohol copolymer. Depending on the quantity of vinyl alcohol in the copolymer, this copolymer can absorb much water.

The middle layer (11, 21, 31, 41) in this case gives the fibre its strength, whilst the relatively thin top layer (12, 22-23, 32a-32b, 43a-43b) absorbs water. This water can be absorbed from the air (in the form of rain, fog, etc.) or can be supplied by an active sprinkler installation. (Often, artificial grass sports fields are sprinkled just before they are played on.)

During play, the absorbed water is released again, which reduces the risk of injury, for example when sliding. Furthermore, the absorbed water keeps the temperature of the field lower, since an artificial grass sports field can be heated by the sun, under adverse conditions to temperatures as high as 70 °C.

Another embodiment of a hydrophilic additive as the outer layer (12, 22-23, 32a-32b, 43a-43b) uses polyhydroxyethyl methacrylate. In order to prevent bonding problems to the middle layer (11, 21, 31, 41), a five-layer co-extrusion configuration is required, as shown in Fig. 1D. The layers 32a-42b are bonding layers for the hydrophilic layer 43a-43b to the central layer 41 in that case.

For illustration purposes, the various layers of the artificial grass fibre (as shown in Figs. 1A-1D) are shown to have different thicknesses. The thicknesses as shown, however, do not correspond to the actual thicknesses of the produced artificial grass

fibres in any way.

In the embodiment in Fig. 1D, the bonding layer 42a-42b is considerably thinner than shown, usually it is 1-5% of the total fibre thickness, whilst the other layers 41-43a-43b are considerably thicker. If polyethylene is used as the middle layer 11-21-31-41, ethylene vinyl alcohol copolymer functioning as the hydrophilic additive will bond to the middle layer without any filling bonding layers being used.

Figs. 2A and 2B show a few embodiments of an artificial grass sports field in which a synthetic fibre according to the invention can be applied. In both figures, the artificial grass sports field comprises a substrate 1, to which several synthetic fibres 2 as obtained by using the method according to the invention are attached at the locations indicated by reference numeral 3, for example by tufting. The synthetic fibre 2 has been obtained from a layer of synthetic material, which material has been produced from at least two different synthetic materials by means of a co-extrusion process. The synthetic fibre may be individually attached to the substrate or as a bundle of, for example intertwined fibres 2a-2c. More in particular, the fibre that is obtained by co-extrusion can be a fibrillated band fibre.

In another embodiment, as shown in Fig. 2B, the synthetic fibre according to the invention may be a monofilament. Also in this case, several monofilaments may be twined to form a bundle, after which each bundle is attached to the substrate 1. In Fig. 2B, the substrate has an open structure and is composed of a grid of supporting yarns 1a-1b, to which the synthetic fibres 2 are attached.

CLAIMS

1. A method for producing a synthetic fibre for use in an artificial grass sports field, comprising the steps of:

i) supplying a layer of synthetic material; and

ii) obtaining the synthetic fibre from the layer of synthetic material, **characterized in that** the layer of synthetic material is composed of at least two layers of different synthetic materials, using a co-extrusion process.

2. A method according to claim 1, **characterized in that** after step i) the layer of synthetic material is stretched.

3. A method according to claim 1, **characterized in that** after step ii) the layer of synthetic material is stretched.

4. A method according to any one or more of the claims 1-3, **characterized in that** the fibre consists of at least one monofilament.

5. A method according to claim 4, **characterized in that** the fibre consists of several twined monofilaments.

6. A method according to any one or more of the claims 1-3, **characterized in that** the fibre is in the form of a band.

7. A method according to claim 6, **characterized in that** the band fibre is a fibrillated band fibre.

8. A method according to any one or more of the claims 1-7, **characterized in that** the layer of synthetic material is composed of a core layer of a first synthetic material, which core layer is surrounded on both sides by any one or more outer layers, each consisting of a different synthetic material.

9. A method according to claim 8, **characterized in that** the layers have different thicknesses.

10. A method according to any one or more of the preceding claims, **characterized in that** the first synthetic material consists of a mixture of a polymer and a plastomer.

11. A method according to claim 10, **characterized in that** the ratio of the plastomer in the core layer is 30-80 wt.%.

12. A method according to claim 11, **characterized in that** the ratio of the plastomer in the core layer is 35-50 wt.%.

13. A method according to any one or more of the preceding claims, **characterized in that** at least one of the other synthetic materials comprises a hydrophilic additive.

14. A method according to claim 13, **characterized in that** the hydrophilic additive is an ethylene vinyl alcohol co-polymer.

15. A method according to claim 13, **characterized in that** the hydrophilic additive is a polyhydroxyethyl methacrylate.

16. A method according to any one or more of the preceding claims, **characterized in that** at least one of the other synthetic materials comprises an antistatic additive.

17. A method according to claim 16, **characterized in that** the antistatic additive is a polymer, in particular a polyamide or a polyether block amide.

18. A synthetic fibre obtained by using the method according to any one or more of the preceding claims.

19. An artificial lawn suitable for sports fields, provided with synthetic fibres according to any one or more of the preceding claims.

20. An artificial lawn according to claim 19, **characterized in that** the lawn comprises a substrate to which the synthetic fibres have been attached.

21. An artificial lawn according to claim 19 or 20, **characterized in that** a granular material has been strewn between the synthetic fibres.

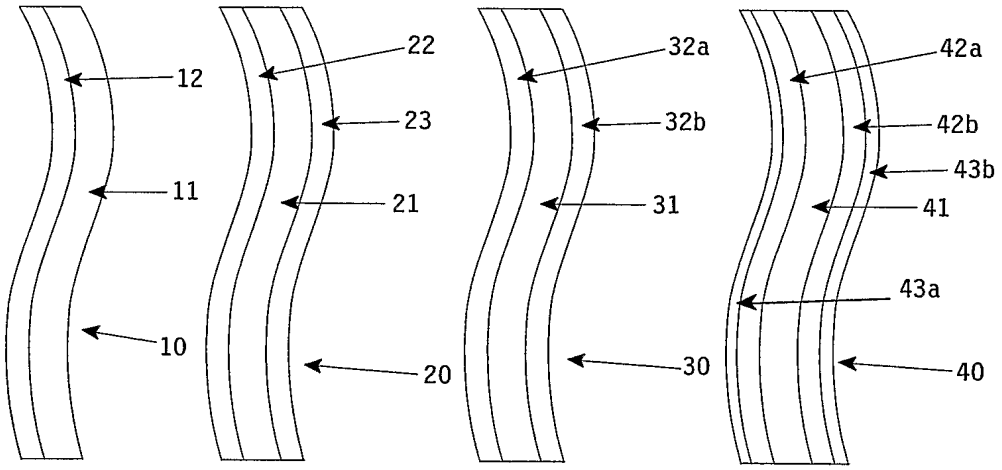

Fig. 1A Fig. 1B Fig. 1C Fig. 1D

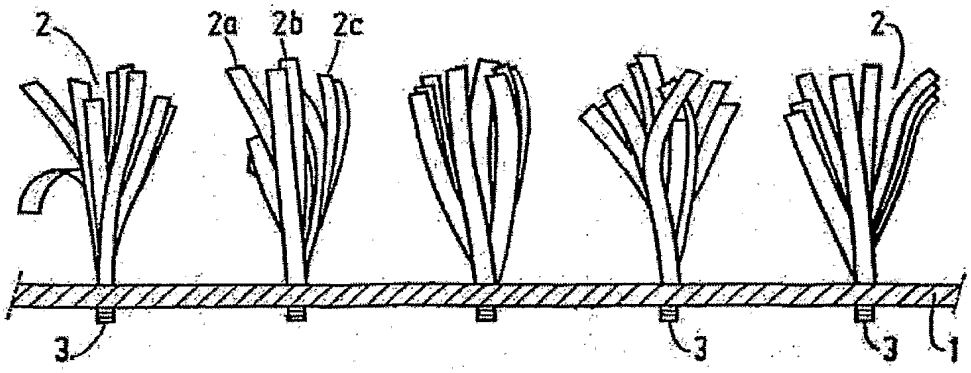

Fig. 2A

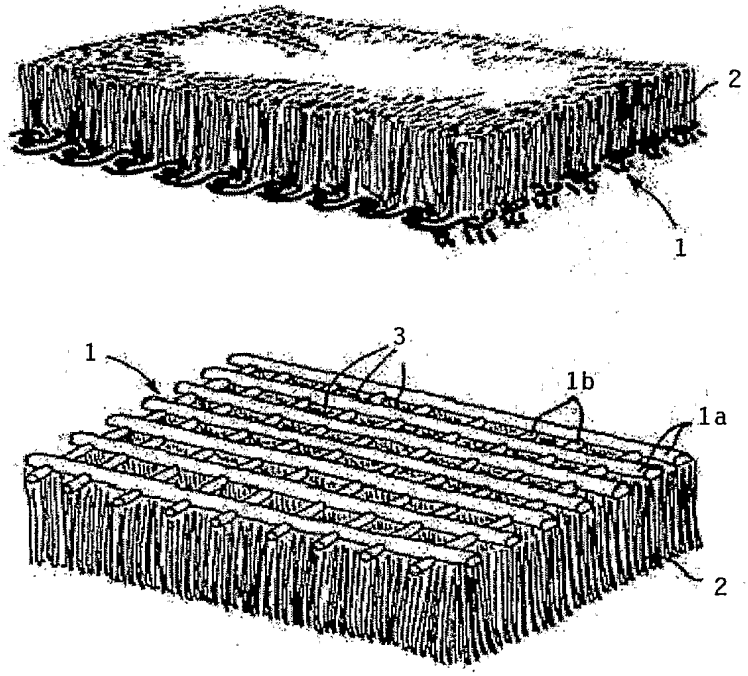

Fig. 2B

INTERNATIONAL SEARCH REPORT

Int. Application No
PCT/NL2005/000275

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D01D5/42 D01F8/06 E01C13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D01D D01F E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 378 592 A (DEX PLASTOMERS V O F ; TEN CATE THIOLON B V (NL)) 7 January 2004 (2004-01-07) paragraphs '0007!, '0009!, '0011!, '0018!, '0029!; claim 21; figures 2a,2b	1-7, 10-12, 18-21
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P,X	WO 2004/106601 A (LANKHORST INDUTECH BV ; ATSMA FRANKE (NL); WILDSCHUT DURK (NL)) 9 December 2004 (2004-12-09) the whole document	1-9, 18-20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 July 2005	03/08/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel (+31-70) 340-2040, Tx 31 651 epo nl, Fax (+31-70) 340-3016	Mangin, S

INTERNATIONAL SEARCH REPORT

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